REMARKS/ARGUMENTS

The Examiner's Office Action and the cited references have been given careful consideration. Following such consideration, claims 1, 4, 5, 18, 22, 24-31, 34-38 and 40 have been amended to define more clearly the patentable invention applicant believes is disclosed herein. Claims 6-17, 21 and 23 were previously cancelled. Claims 2, 3, 19, 20, 32, 33, 39 and 41 are unchanged by the present amendment. It is respectfully requested that the Examiner reconsider the claims in their present form, together with the following comments, and allow the application.

The present application was subject to a Restriction Requirement wherein the applicant elected, without traverse, the invention of Species 1 associated with claims (1, 24, 30, 31 and 32) and 25; and claims (18, 33, 39, 40 and 41) and 34, which are drawn to combustion optimization. Accordingly, claims 1-5, 18-22, 24-25, 30-34, and 39-41 were examined in connection with the outstanding Office Action, and remain pending in the present application.

Rejection Under 35 U.S.C. 101

Claims 1-5 and 24-32 have been rejected as being directed to non-statutory subject matter. In particular, the Examiner has noted that the method steps of claims 1-5 and 24-32 do not require the use of a machine, and thus may be performed using only human intelligence. The Examiner has also rejected claim 22 under 35 U.S.C. 101 for failing to provide "patentable utility."

The foregoing claims have now been carefully considered in view of the Examiner's comments in the 35 U.S.C. 101 rejection. In this respect, independent claim 1 has now been extensively amended to clearly define the applicant's method for assigning credit in connection with apparatus, such as a fossil fuel power plant, process management modules, model-based controller, and local processor. A "process management module" includes a processor, as described at paragraph [0034] of the specification. Furthermore, claim 22 has also been significantly amended to define the type of adaptations for the "first-order-differentiable model." In addition, dependent claims 4, 5 and 30 have been amended to clearly define the limitations as relating to a "method."

The Examiner has noted with respect to claims 1-5 and 24-32 that there is no requirement in the claims that a machine be used, and therefore the Examiner concludes that the subject matter of the claims may be performed using only human intelligence, which has been held to be non-statutory subject matter. In view of the amendments made to independent claim 1, with respect to the association of the method with specific apparatus, it is respectfully submitted that a "machine" must be used in order to implement the claimed method.

In view of the foregoing, it is respectfully submitted that claims 1-5, 22 and 24-32 now recite statutory subject matter in accordance with the requirements of 35 U.S.C. 101. Therefore, withdrawal the 35 U.S.C. 101 rejection is respectfully requested.

Rejection Under 35 U.S.C. 112, First Paragraph

The Examiner has rejected claims 24, 25, 32, 34 and 41 for failing to comply with the "enablement requirement" of 35 U.S.C. 112, first paragraph.

With respect to claim 24, the Examiner argues that the "first process of a fossil fuel power plant" cannot be an "optimization." It should be noted that claim 24 defines the "first and second processes for operation of the fossil fuel power plant" as being processes selected from a group of several optimization processes. It is respectfully submitted that the subject matter defined by claim 24 is enabled by the applicant's disclosure. For example, the Examiner is directed to paragraphs [0033]-[0035] and FIG. 3 in the applicant's disclosure.

With regard to claims 25, 32, 34 and 41, the Examiner argues that the recited claim limitations cannot be a "process." However, it should be noted that the foregoing claims define a group from which a "first input" for a "process" is selected. Therefore, the claim limitations do not relate to the process, but rather relate to the "input" for the process. In view of the foregoing, it is respectfully submitted that claims 24, 25, 32, 34 and 41 comply with the enablement requirement of 35 U.S.C. 112, first paragraph. Therefore, withdrawal of this rejection is respectfully requested.

Rejection Under 35 U.S.C. 112, Second Paragraph

Claims 1-5, 18-20, 22, 24, 25, 31, 33, 34, 39 and 40 have been rejected under 35 U.S.C. 112, second paragraph for "indefiniteness." The Examiner has noted that several terms in the claims are unclear, and that some of the claims omit essential steps.

The rejected claims have been carefully reviewed and appropriate amendments have been made to clarify the claim language and method steps discussed in the Office Action.

To further address the issues raised by the Examiner in this rejection, the applicant notes the following:

1) The term "chained output" is a recognized term of art, and is illustrated in detail in FIG. 1. See also paragraph [0003] that describes "Output y2" (chained output).
2) The term "credit" is now defined in the claims.
3) The term "differentiable model" is a recognized term of art that is described at paragraph [0024].
4) The way in which a "credit assignment" is obtained is disclosed at FIG. 4 and at paragraphs [0025] and [0027].
5) The term "first-principles model" is a well known term of art referring to a modeling technique that relies on fundamental laws of physics.

With respect to claims 24 and 25 the first process of a fossil fuel power plant is optimized in accordance with optimizers such as shown in FIG. 3 and described at paragraphs [0033]-[0035].

Applicant's Invention

The present invention is directed to a method for assigning credit to inputs of a process for operation of a fossil fuel power plant is composed of a number of stages of interconnected local processes. Credit is used to measure the contribution of a particular variable (i.e., input) on a component. Credit can also be used for determining the sensitivity of a component to a contributing variable and the impact of adjusting that variable. Assigning credit is a mechanism for evaluating the impact of a particular variable, e.g., an input to one of the local processes, on the final output of the aggregate process.

In certain embodiments of the present invention, credit is assigned to the local inputs of each local process in two steps. First, for each local input, a local credit assignment is obtained. Second, a global credit assignment is derived for the local inputs from the local credit assignment and credit assignment information from later stage processes. The credit assignment information from later-stage processes includes the credit assignments for the chained outputs (of an earlier-stage process) as calculated for the later-stage processes to which the outputs are chained.

Credit assignment information generated for later-stage processes can be applied, i.e., backpropagated, to earlier-stage processes. Credit is assigned throughout the hierarchy by beginning with the terminal node at the final stage and iterating through the hierarchy of processes from later stages to earlier stages.

Certain embodiments of the present invention use the chain rule for ordered partial derivatives together with credit assignment information from later stages for assigning credit to the local inputs of a particular process. In certain embodiments of the present invention, each local process has a corresponding first-order differentiable representation. Beginning with the terminal process, an initial step involves obtaining the partial derivative of the system's objective function with respect to each of the inputs to the top-most process. The results for inputs that are intermediate inputs, i.e., outputs of a preceding local process, are then backpropagated to the earlier preceding local process and used to obtain the partial derivative of the global output with respect to each of the inputs to the earlier-stage process by applying the chain rule. In certain embodiments, this procedure is repeated in order to generate credit assignment functions for all of the local inputs distributed throughout the system.

In certain embodiments, each local process is typically operated by a process management module. The process management module includes a service that calculates the credit assignment of at least one of its inputs with respect to at least one later-stage output, which may be one of the global outputs. In certain contemplated embodiments, the process management module uses a model of the process (e.g., a neural network model or a first principles model) and credit assignments of its chained local outputs with respect to the desired later-stage output to calculate the credit assignments of its inputs. The credit assignment can be used as an indication of the sensitivity of the global output to changes in the local input in real-time under a current set of operating conditions. In certain embodiments, process management modules can calculate global

credit assignments for inputs of processes managed by other process management modules, using data provided by the respective process management modules.

The process management module can pass local or global credit assignments to other process management modules. Credit assignments may change when the operating region of the system changes or when a local model for a process changes, e.g., through adaptation. The local process management modules are typically implemented in a distributed computing environment.

Rejection Under 35 U.S.C. 103

Claims 1-5, 18-22, 24, 25, 30-34 and 39-41 have been rejected as being obvious in view of the combined teachings of Soestbergen et al. (US 2002/0143693) and Werbos (US 6,532,454).

With respect to claim 1, the Examiner states that Soestbergen et al. relates to a method and system for a global online venue for the issuing of Emission Reduction Credits (ERCs) to renewable energy systems, and for transferring of the ERCs to systems in need of ERCs. Soestbergen et al. is specifically directed to a method and system for the banking and trading of ERCs.

Furthermore, the Examiner acknowledges that Soestbergen et al. fails to explicitly teach:

> using a first-order differentiable model of the first process of the fossil fuel power plant to derive a local credit assignment for the first input; and
>
> applying a chain rule for ordered partial derivatives using the first-order differentiable model, the local credit assignment for the first input, and the credit assignments for the chained outputs of the first process with respect to the global output to assign credit to the first input with respect to the global output of the network.

Accordingly, the Examiner relies upon Werbos for teaching: "BTT [26] can be used to reduce the cost of computing exact derivative through any feedforward differentiable system, not just neural networks'" (column 4, lines 47-49) and "This is not a complete description of the problem, because it does not specify how to compute the derivatives that appear in equation 21. This is not just a matter of computation; there is also a need to specify which partial derivatives or gradient are used."

The Examiner concludes that "[i]t would have been obvious to one of ordinary skill in the art at the time of the invention to include differential models as taught by Werbos US 6,532,454

B1 in the system of Soestbergen US 2002/0143639 A1, for the purpose of credit assignment calculation, since the claimed invention is merely a combination of old elements, and in the combination each element merely would have performed the same function as it did separately, and one of ordinary skill in the art would have recognized that the results of the combination were predictable."

It is respectfully submitted that neither Soestbergen et al. nor Werbos, taken individually or in combination, anticipates or renders obvious the applicant's invention as now defined by the amended claims. In particular, it should be noted that neither cited reference is directed to a method for assigning a *credit* that measures the contribution of an input to a *global output* of a network, wherein the global output is a *profit* generated by operation of the fossil fuel power plant.

As indicated above, independent claims 1 and 18 have been amended to explicitly define the meaning of the term "credit" and to the meaning of the term "global output." Accordingly, it is submitted that the claimed invention as defined by independent claims 1 and 18 are patentable over the cited references.

Claims 2-5 and 24-32 depend from independent claim 1, and claims 19-20, 22 and 33-41 depend from independent claim 18. It is respectfully submitted that these dependent claims are likewise patentable over the cited references for at least the reasons discussed above in connection with independent claims 1 and 18.

Conclusion

In view of the foregoing comments, it is respectfully submitted that the present application is now in proper condition for allowance. If the Examiner believes there are any further matters that need to be discussed in order to expedite the prosecution of the present application, the Examiner is invited to contact the undersigned.

If there are any fees necessitated by the foregoing communication, please charge such fees to our Deposit Account No. 50-0537, referencing our Docket No. NC9441US.

Respectfully submitted,

Date: **December 11, 2009**

Michael A. Jaffe
Registration No. 36,326

Kusner & Jaffe
Highland Place – Suite 310
6151 Wilson Mills Road
Highland Heights, Ohio 44143
(440) 684-1090 (phone)
(440) 684-1095 (fax)

MAJ/lc